



**FINAL INVESTIGATION REPORT  
ON  
HARD LANDING INCIDENT TO  
M/S INDIGO AIRLINE, A-320 AIRCRAFT VT-IGK,  
WHILE LANDING AT  
SWAMI VIVEKANAND AIRPORT, RAIPUR  
ON  
14.12.2016**



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**DIRECTORATE GENERAL OF CIVIL AVIATION**  
OPPOSITE SAFDARJUNG AIRPORT, AUROBINDO MARG, NEW DELHI-110003

**DISCLAIMER**

*In accordance with the Rule 3 (1) of Aircraft (Investigation of Accidents and Incidents) Rules, 2012, "The sole objective of investigation of this incident is the prevention of accidents and incidents and not to apportion a blame or liability."*

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**INVESTIGATION REPORT ON HARD LANDING INCIDENT TO**  
**M/S INDIGO AIRLINES A320 AIRCRAFT VT-IGK AT RAIPUR AIRPORT**  
**ON 14.12.2016**

1. Aircraft Type : A 320-232  
Nationality : Indian  
Registration : VT-IGK
2. Owner : M/s Interglobe Aviation Ltd
3. Operator : M/s Interglobe Aviation Ltd
4. Pilot in Command : ATPL Holder  
Extent of Injury : Nil
5. Place of Incident : Swami Vivekananda Airport, Raipur
6. Geographical Location of Site : 21°10'52"N, 81°44'18.5"E
7. Last point of Departure : IGI Airport, Delhi
8. Intended place of landing : Swami Vivekananda Airport, Raipur
9. Type of operation : Schedule Flight
10. Date and time of Incident : 14/12/2016, 14:31 Hrs
11. Passengers/Crew on Board : Crew-07,  
Passenger- 167  
Extent of Injury : Nil
12. Phase of Operation : Landing
13. Type of Incident : Abnormal Runway Contact

**(All the timing in the report is in IST)**

## **SYNOPSIS**

On 14<sup>th</sup> December 2016, an A320 aircraft VT-IGK of M/s Indigo Airlines was involved in hard landing incident during landing at Swami Vivekananda Airport, Raipur, while operating a scheduled flight 6E-201 from Delhi to Raipur.

The aircraft took-off from Delhi at 13:08 Hrs to Raipur. The flight was planned for SLF (Supervised Line Flying). The controls were with the First Officer. The approach to runway 24 was made ILS. The aircraft was properly configured and approach was normal with minor deviations till 50 ft of Radio Altitude. Passing 50 ft the PIC noticed weak flare and advised the First Officer to correct it. At last, PIC gave the input to improve the flare however, aircraft made the touch-down and bounced on runway 24 with a vertical acceleration of 2.512g followed by vertical acceleration of 3.164g .

There were 07 crew and 167 passengers on board the aircraft. All the persons on-board the aircraft were safe. No pre/post incident fire was reported.

DGCA ordered the investigation of the incident by appointing an Inquiry Officer under Rule 13(1) of the Aircraft (Investigation of Accidents and Incidents) Rules, 2012.

### **1. FACTUAL INFORMATION**

#### **1.1. HISTORY OF THE FLIGHT:**

On 14<sup>th</sup> December 2016, the aircraft VT-IGK commenced its first flight from Hyderabad at 06:44 Hrs with a different set of crew and operated two sectors i.e. Hyderabad to Vizag and Vizag to Delhi. Flight during both the sectors was uneventful.

At Delhi the aircraft VT-IGK was handed over to another set of crew. This was the first flight of the day for the Pilot in Command (PIC). However, the First officer had flown one sector from Bangalore to Delhi with another aircraft as passenger to operate the flight from Delhi. The First Officer had reported at Bangalore at 07:02 Hrs for Pre-Flight Medical Examination. She was not found under the influence of Alcohol consumption during the pre-flight medical check. She travelled from

Bangalore to Delhi on another aircraft to operate flight from Delhi to Raipur. The involved Pilot-in-Command (PIC) reported at Delhi at 12:17 Hrs for PFMC and no indication of Alcohol consumption by him was observed during the medical examination.

The aircraft VT-IGK was released by a certified AME after carrying out the due transit inspection at Delhi. The aircraft took-off from Delhi at 13:08 Hrs for Raipur and it was SLF (Supervised Line Flying) for training of the First Officer. Controls were with the First Officer. The take-off & cruise from Delhi to Raipur was normal. However, during approach at Raipur, ILS approach was performed for runway 24. The aircraft was properly configured and approach was normal with minor deviations till 50 ft of Radio Altitude. Passing 50 ft the PIC noticed weak flare and advised the First Officer to correct it. At last the PIC gave the input to improve the flare however, aircraft made the touch-down at 14:31 hrs. and made a bounced landing on runway 24 with a vertical acceleration of 2.512g followed by 3.164g which was more than the structural limit of 2.6g as specified by the manufacturer. The landing was classified as Hard Landing.

Weather was normal at Raipur. Visibility was 6 Km with minor variation in wind direction from 07° to 04° and wind speed 08 kts to 05 kts.

## 1.2. INJURIES TO PERSON

<b>INJURIES</b>	<b>CREW</b>	<b>PASSENGERS</b>	<b>OTHERS</b>
<b>FATAL</b>	Nil	Nil	Nil
<b>SERIOUS</b>	Nil	Nil	Nil
<b>MINOR</b>	Nil	Nil	Nil
<b>NONE</b>	07	167	

### 1.3. DAMAGE TO AIRCRAFT

None.

### 1.4. OTHER DAMAGE

NIL

### 1.5 PERSONNEL INFORMATION:

#### 1.5.1. Pilot-in-Command

He was an experienced pilot having vast flying experience on various aircraft. He was an authorised Line Training Captain (LTC). He was not involved in any Accidents or Serious Incidents previously. Details of his experience at the time of incident are given below:

Gender	:	Male
Date of Birth	:	20.02.1976
License type	:	ATPL
Valid up to	:	26 <sup>th</sup> April. 2017
Aircraft Ratings:		
As PIC	:	A320, Cessna 152, Cessna 172, Cessna 310, KingAir C-90
As FO	:	A320, CRJ-200
Date of Initial Issue	:	27.04.2007
Date of Endorsement	:	12.04.2008 for Airbus 320
Medical Valid up to	:	03.01.2017
FRT0 No, valid till	:	7915, Valid till 23.07.2017
Date of last IR check	:	06.11.2016
PC check	:	06.11.2016

#### **Flying Details:**

Total Flying Experience	:	9801:53 hrs
Total Flying as PIC	:	6999:20 Hrs.
Total Experience as PIC on type	:	6827:20 Hrs.

Flying during Last One year : 429:16 Hrs.  
Flying during last 6 months : 193:44 Hrs.  
Flying during Last 30 days : 42:04 Hrs.  
Flying during last 7 days : 08:36 Hrs.  
During last 24 hours : 01:44 hrs

### **1.5.2. Co-Pilot**

Gender : Female  
Date of Birth : 06.09.1981  
Type of Licence : CPL,  
Valid till : 15<sup>th</sup> November, 2021  
Aircraft Ratings:  
As PIC : Cessna 172, Piper Seneca PA 34  
As FO : A -320  
Date of Initial Issue : 16.11.2011  
Date of Endorsement : 02.06.2016 for A 320  
Medical Valid up to : 21.06.2017  
FRTO No, valid till : 16685, valid till 15.11.2021  
Date of last IR check : 23.10.2016  
PC check : 23.10.2016

### **Flying Details:**

Total Flying Experience : 351:21 Hrs  
Total Experience as FO on type : 69:00 Hrs  
Flying during Last One year : 71:25 Hrs.  
Flying during last 6 months : 71:25 Hrs  
Flying during Last 30 days : 42:00 Hrs  
Flying during last 7 days : 06:37 Hrs  
During last 24 hours : 01:44 Hrs

Both the crew have undergone pre-flight breath analyser check before operating the flight as per the provision of CAR Section 5 Series F Part III. No indication of alcohol

consumption by any of the involved crew was observed during the check. No exceedance in the Flight Duty Time for both the crew was observed as per the record available.

After involvement in the hard landing incident, privileges of pilot license held by both the crew were suspended by DGCA as per clause (b) of sub-rule (3) of Rule 19 of Aircraft Rules, 1937.

#### 1.6 AIRCRAFT INFORMATION:

Aircraft:	
<b>Manufacturer</b>	Airbus Industries
<b>Type</b>	A-320-232
<b>Constructor's S.No.</b>	4216
<b>Year of Manufacturer</b>	2010
<b>Certificate of Airworthiness</b>	6178, Issued on 22.02.2010, Valid till 21.02.2015
<b>Airworthiness Review Certificate</b>	No. DDG/NR/ARC/2015/046, dated 20.02.2015 Valid till 19.02.2016 Renewal 20.02.2016, valid till 19.02.2017
<b>Category</b>	Normal
<b>Sub Division</b>	Passenger.
<b>Certificate of Registration no. and validity</b>	No. 4069 Validity: N/A
<b>Owner</b>	M/s Interglobe Aviation Ltd
<b>Minimum Crew Required</b>	02
<b>Maximum All Up Weight Authorised</b>	73,500 Kg



<b>Last Major Inspection</b>	750 Hrs/120 days at aircraft TSN 24155 Hrs on 10.12.2016
<b>Last Inspection</b>	Layover Inspection on 13.12.2016 at aircraft TSN 24184:08 Hrs
<b>Air frame Hrs. Since New</b>	24188:33 Hrs/ 16571 Cycles as on 14.12.16

<b>Engine</b>	
<b>Manufacturer</b>	IAE.
<b>Type</b>	IAE V2527-AS
<b>Serial No.</b>	LH – V15347 RH – V10001
<b>Hours Done Since New</b>	LH Engine: 19080 Hrs (as on 14.12.2016) RH Engine: 24519 Hrs (as on 14.12.2016)
<b>TSO</b>	LH Engine: 4691 Hrs (as on 14.12.2016) RH Engine: 34 Hrs. (Installed on 10.12.2016)
<b>Last Inspection Carried Out</b>	Layover Inspection on 13.12.2016 at aircraft TSN 24184:08 Hrs
<b>Average Fuel Consumption</b>	Satisfactory

On 14.12.2016, the aircraft VT-IGK operated first flight from Hyderabad to Vizag. At vizag, during transit inspection, AME observed CAT-II operation 'INOP'. The aircraft downgraded to CAT-I operation and released to operate flight from Vizag to Delhi. On arrival at Delhi, Multi Mode Receiver (MMR-1) replaced as per AMM and aircraft upgraded to CAT-III operation.

As per the load and trim sheet, the calculated ALW (All-up Landing Weight) was 61,537Kg which was 2963 Kg below the maximum landing weight. C.G. with LIZFW (Loaded Index at Zero Fuel Weight) was 68.2% and with LITOW (Loaded Index at

Take-off Weight) was 65.6% from datum point, which were within the limits. As per manufacturer, C.G. can vary from 36.8% to 87.62% with LIZFW and from 33.48% to 90.76% with LITOW.

### **1.7 METEOROLOGICAL INFORMATION:**

Weather was obtained from the Meteorological Department, Weather report for Raipur Airport is given below:

**VERP 140630Z 06008KT 6000 NSC 27/08 Q1017 NOSIG=**

**VERP 140730Z 07008KT 6000 NSC 28/10 Q1015 NOSIG=**

**VERP 140800Z 07005KT 6000 NSC 28/10 Q1015 NOSIG=**

**VERP 140830Z 05005KT 6000 NSC 28/11 Q1015 NOSIG=**

**VERP 140900Z 04005KT 6000 SCT100 28/11 Q1014 NOSIG=**

**VERP 140930Z 05002KT 6000 FEW100 29/11 Q1014 NOSIG=**

**VERP 141000Z 05002KT 6000 FEW100 29/11 Q1014 NOSIG=**

**VERP 141030Z 06005KT 6000 NSC 28/11 Q1014 NOSIG=**

As per the above weather report, weather at Raipur was normal before the take-off time from Delhi and during the whole flight till landing at Raipur. Visibility was 6 Km with minor variation in wind direction from 07° to 04° and wind speed 08 kts to 05 kts. Aircraft landed on RWY 24 with less tail wind conditions.

### **1.8 AIDS TO NAVIGATION:**

Raipur Airport is equipped with navigational aids like ILS, DME, DVOR, NDB, PAPI etc. Night landing facility on RWY 24 was available with CAT I Instrument Landing System (ILS). No limitation on serviceability/use of any navigational aid was reported by ATC at the time of incident.

## **1.9 COMMUNICATIONS:**

Two way communications was available at Raipur Airport. No unavailability of any communication aid was reported by the ATC as well as by the flight crew.

## **1.10 AERODROME INFORMATION:**

Raipur Airport is known as Swami Vivekanand International Airport, Raipur. It is primary international airport in the Chhattisgarh state. It has single runway 06/24 having dimensions 2286m x 45m. The airport is located 15 Km from Raipur. It's geographic location is at Latitude 21°10'52"N, and Longitude 081°44'18.5"E.

## **1.11 FLIGHT RECORDERS:**

The aircraft was fitted with both CVR and DFDR of Honeywell Company.

CVR : Part No. 980 - 6022 – 001            S.No. CVR 120-14588

DFDR : Part No. 980 – 4700 – 042        S. No. SSFDR-17743

As per DFDR data, no input from the PIC was recorded till 8ft of Radio Altitude. Aircraft controls were with the First Officer. Rate of descent (ROD) was normal and pitch angle remained steady at 2.1° from 100ft radio altitude to 10ft. At 8ft above the runway, the sudden pitch input by PIC was recorded and pitch angle increased from 2.1° to 4.9° at the time of touch-down within a period of 0.875 seconds with ROD 585 ft/min. The vertical acceleration at the time of touch-down was recorded 2.512g and aircraft bounced upto 9ft within 2.125 seconds after touch-down and again touched-down the runway with pitch angle 6.3°, at ROD 668 ft/min with vertical acceleration 3.164g against the structural limit 2.6g as specified by the manufacturer. DFDR reading at 0.125 Seconds interval for 500 ft Radio Altitude (RA) is shown below:

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:30:48.000						-982			22.5				0.938
14:30:48.125			1.1				0	0					0.938
14:30:48.250											0	0	0.938
14:30:48.375			1.1	-2.1									0.93
14:30:48.500					240					22.5			0.977
14:30:48.625			1.1				0	0.4					1.004
14:30:48.750	517												1.016
14:30:48.875		518	1.1	-0.7									0.996
14:30:49.000						-921			22.5				0.996
14:30:49.125			1.1				0	0.5					1.004
14:30:49.250											0	0	0.977
14:30:49.375			1.1	1.1									0.984
14:30:49.500					240					22.5			0.996
14:30:49.625			1.1				0	0.4					0.977
14:30:49.750	499												0.965
14:30:49.875		496	0.7	2.8									0.984
14:30:50.000						-883			22.5				0.977
14:30:50.125			0.7				0	0					0.965
14:30:50.250											0	0	0.949
14:30:50.375			0.7	3.5									0.957
14:30:50.500					240					22.5			0.965
14:30:50.625			0.7				0	0					0.957
14:30:50.750	464												0.965
14:30:50.875		478	0.7	4.2									0.977
14:30:51.000						-882			22.5				0.949
14:30:51.125			0.4				0	0					0.93
14:30:51.250											0	0	0.918
14:30:51.375			0.4	3.5									0.91
14:30:51.500					241					22.5			0.918
14:30:51.625			0.7				0	0					0.891
14:30:51.750	456												0.879
14:30:51.875		460	0.7	1.4									0.898
14:30:52.000						-973			22.5				0.91
14:30:52.125			0.7				0	0.6					0.898

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:30:52.250											0	0	0.898
14:30:52.375			1.1	-0.7									0.93
14:30:52.500					242					22.5			0.949
14:30:52.625			1.1				0	1.1					0.949
14:30:52.750	446												0.965
14:30:52.875		451	1.1	-3.2									0.984
14:30:53.000						-995			22.5				0.977
14:30:53.125			1.1				0	0.8					0.965
14:30:53.250											0	0	0.965
14:30:53.375			1.1	-4.6									0.984
14:30:53.500					242					22.5			0.977
14:30:53.625			1.1				0	0					0.949
14:30:53.750	424												0.957
14:30:53.875		437	1.1	-5.3									0.965
14:30:54.000						-982			22.5				0.938
14:30:54.125			1.1				0	0					0.938
14:30:54.250											0	0	0.93
14:30:54.375			1.1	-4.2									0.938
14:30:54.500					240					22.5			0.918
14:30:54.625			1.1				0	0					0.918
14:30:54.750	404												0.93
14:30:54.875		417	1.1	-2.5									0.93
14:30:55.000						-1019			22.5				0.938
14:30:55.125			1.1				0	0					0.93
14:30:55.250											0	0	0.938
14:30:55.375			1.1	-0.7									0.918
14:30:55.500					240					22.5			0.938
14:30:55.625			1.1				0	0					0.938
14:30:55.750	385												0.938
14:30:55.875		400	1.1	1.4									0.93
14:30:56.000						-1047			22.5				0.938
14:30:56.125			1.4				0	0					0.949
14:30:56.250											0	0	0.93
14:30:56.375			1.4	3.9									0.957

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:30:56.500					240					22.5			0.965
14:30:56.625			1.4				0	-5.4					0.957
14:30:56.750	367												0.957
14:30:56.875		373	1.4	4.6									0.949
14:30:57.000						-1011			22.5				0.965
14:30:57.125			1.8				0	-5.1					0.984
14:30:57.250											0	0	0.996
14:30:57.375			2.1	4.2									1.016
14:30:57.500					241					22.5			1.004
14:30:57.625			2.5				0	-4.7					1.004
14:30:57.750	355												1.016
14:30:57.875		359	2.8	2.5									1.004
14:30:58.000						-900			22.5				1.016
14:30:58.125			3.5				0	-4.9					1.004
14:30:58.250											0	0	1.004
14:30:58.375			3.9	0.7									1.016
14:30:58.500					242					22.5			1.016
14:30:58.625			4.2				0	-3.9					1.023
14:30:58.750	338												1.035
14:30:58.875		346	4.6	-1.1									1.035
14:30:59.000						-761			22.5				1.043
14:30:59.125			4.9				0	-1.4					1.063
14:30:59.250											0	0	1.063
14:30:59.375			4.9	-3.2									1.07
14:30:59.500					242					22.5			1.07
14:30:59.625			5.3				0	-1.4					1.07
14:30:59.750	325												1.07
14:30:59.875		335	5.3	-5.3									1.055
14:31:00.000						-594			22.5				1.055
14:31:00.125			5.3				0	-0.1					1.055
14:31:00.250											0	0	1.043
14:31:00.375			5.3	-6.3									1.035
14:31:00.500					241					22.5			1.004
14:31:00.625			5.3				0	0					0.984

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:31:00.750	314												0.977
14:31:00.875		321	5.3	-5.6									0.965
14:31:01.000						-499			22.5				0.965
14:31:01.125			5.3				0	0					0.977
14:31:01.250											0	0	0.996
14:31:01.375			5.3	-3.5									0.984
14:31:01.500					239					22.5			0.996
14:31:01.625			5.3				0	0					0.977
14:31:01.750	300												0.977
14:31:01.875		308	5.3	-0.4									0.977
14:31:02.000						-450			22.5				0.965
14:31:02.125			5.3				0	0					0.977
14:31:02.250											0	0	0.984
14:31:02.375			5.3	2.8									1.004
14:31:02.500					239					22.5			0.996
14:31:02.625			5.3				0	0					0.996
14:31:02.750	296												1.004
14:31:02.875		300	5.3	4.2									1.004
14:31:03.000						-391			22.5				0.996
14:31:03.125			5.3				0	0					0.996
14:31:03.250											0	0	0.984
14:31:03.375			5.3	4.6									0.965
14:31:03.500					240					22.5			0.965
14:31:03.625			4.9				0	0					0.938
14:31:03.750	289												0.938
14:31:03.875		295	4.9	3.9									0.949
14:31:04.000						-388			22.5				0.938
14:31:04.125			5.3				0	0					0.93
14:31:04.250											0	0	0.93
14:31:04.375			5.3	2.1									0.938
14:31:04.500					241					22.5			0.938
14:31:04.625			5.3				0	0					0.957
14:31:04.750	280												0.996
14:31:04.875		285	5.3	0.7									1.016

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:31:05.000						-350			22.5				1.004
14:31:05.125			5.3				0	0					1.016
14:31:05.250											0	0	0.996
14:31:05.375			5.3	0									0.965
14:31:05.500					242					22.5			0.965
14:31:05.625			5.3				0	1					0.949
14:31:05.750	273												0.93
14:31:05.875		281	4.9	-0.7									0.93
14:31:06.000						-366			22.5				0.918
14:31:06.125			4.9				0	0					0.918
14:31:06.250											0	0	0.891
14:31:06.375			4.9	-1.4									0.891
14:31:06.500					241					22.5			0.898
14:31:06.625			4.9				0	5.7					0.91
14:31:06.750	267												0.93
14:31:06.875		268	4.6	-1.8									0.91
14:31:07.000						-476			22.5				0.91
14:31:07.125			4.6				0	6.7					0.898
14:31:07.250											0	0	0.891
14:31:07.375			4.2	-1.4									0.879
14:31:07.500					241					22.5			0.891
14:31:07.625			3.9				0	6					0.879
14:31:07.750	260												0.879
14:31:07.875		262	3.2	-1.1									0.891
14:31:08.000						-591			22.5				0.91
14:31:08.125			2.8				0	1.5					0.918
14:31:08.250											0	0	0.91
14:31:08.375			2.5	-1.4									0.91
14:31:08.500					240					22.5			0.93
14:31:08.625			2.5				0	-0.3					0.898
14:31:08.750	251												0.891
14:31:08.875		253	2.1	-1.8									0.879
14:31:09.000						-667			22.5				0.891
14:31:09.125			1.8				0	0					0.891



Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:31:09.250											0	0	0.879
14:31:09.375			1.8	-2.1									0.879
14:31:09.500					240					22.5			0.879
14:31:09.625			1.8				0	-1					0.879
14:31:09.750	236												0.91
14:31:09.875		242	1.8	-3.2									0.93
14:31:10.000						-733			22.5				0.91
14:31:10.125			1.8				0	0.2					0.918
14:31:10.250											0	0	0.918
14:31:10.375			1.8	-3.2									0.93
14:31:10.500					239					22.5			0.91
14:31:10.625			1.4				0	0.7					0.918
14:31:10.750	225												0.938
14:31:10.875		232	1.4	-1.4									0.91
14:31:11.000						-792			22.5				0.918
14:31:11.125			1.4				0	0.4					0.93
14:31:11.250											0	0	0.91
14:31:11.375			1.4	0.4									0.91
14:31:11.500					239					22.5			0.898
14:31:11.625			1.4				0	0.3					0.918
14:31:11.750	213												0.918
14:31:11.875		219	1.4	1.4									0.918
14:31:12.000						-845			22.5				0.949
14:31:12.125			1.4				0	0					0.949
14:31:12.250											0	0	0.938
14:31:12.375			1.4	1.1									0.949
14:31:12.500					239					22.5			0.957
14:31:12.625			1.4				0	1					0.938
14:31:12.750	199												0.949
14:31:12.875		205	1.4	0									0.949
14:31:13.000						-874			22.5				0.949
14:31:13.125			1.4				0	0.8					0.938
14:31:13.250											0	0	0.957
14:31:13.375			1.4	-1.1									0.949

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:31:13.500					239					22.5			0.949
14:31:13.625			1.4				0	-0.6					0.949
14:31:13.750	185												0.957
14:31:13.875		192	1.4	-1.1									0.957
14:31:14.000						-878			22.5				0.949
14:31:14.125			1.4				0	-1					0.957
14:31:14.250											0	0	0.957
14:31:14.375			1.4	-1.4									0.957
14:31:14.500					239					22.5			0.949
14:31:14.625			1.4				0	-3					0.938
14:31:14.750	167												0.918
14:31:14.875		173	1.4	-1.1									0.898
14:31:15.000						-876			22.5				0.91
14:31:15.125			1.4				0	-3					0.949
14:31:15.250											0	0	0.965
14:31:15.375			1.8	-0.7									0.977
14:31:15.500					239					22.5			1.023
14:31:15.625			2.1				0	-3.2					1.043
14:31:15.750	152												1.043
14:31:15.875		159	2.1	-0.7									1.016
14:31:16.000						-789			22.5				1.004
14:31:16.125			2.5				0	-1.1					0.996
14:31:16.250											0	0	0.996
14:31:16.375			2.5	-1.1									1.016
14:31:16.500					239					22.5			1.004
14:31:16.625			2.5				0	0.1					0.977
14:31:16.750	137												0.977
14:31:16.875		148	2.5	-1.4									0.977
14:31:17.000						-731			22.5				0.977
14:31:17.125			2.5				0	0.8					0.965
14:31:17.250											0	0	0.977
14:31:17.375			2.5	-0.7									0.977
14:31:17.500					239					22.5			0.957
14:31:17.625			2.5				0	0					0.957

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:31:17.750	126												0.949
14:31:17.875		136	2.5	1.1									0.965
14:31:18.000						-709			22.5				0.965
14:31:18.125			2.5				0	0					0.965
14:31:18.250											0	0	1.004
14:31:18.375			2.5	1.8									0.984
14:31:18.500					239					22.5			0.996
14:31:18.625			2.5				0	0					1.004
14:31:18.750	113												1.004
14:31:18.875		118	2.5	1.8									0.996
14:31:19.000						-632			22.5				0.996
14:31:19.125			2.5				0	0					1.016
14:31:19.250											0	0	0.965
14:31:19.375			2.5	1.1									0.977
14:31:19.500					239					22.5			0.977
14:31:19.625			2.5				0	0					0.996
14:31:19.750	102												0.984
14:31:19.875		104	2.5	-0.4									0.984
14:31:20.000						-581			22.5				0.984
14:31:20.125			2.1				0	0					0.977
14:31:20.250											0	0	0.957
14:31:20.375			2.1	-1.1									0.93
14:31:20.500					239					22.5			0.93
14:31:20.625			2.1				0	0					0.91
14:31:20.750	85												0.91
14:31:20.875		91	2.1	-1.1									0.918
14:31:21.000						-604			22.5				0.93
14:31:21.125			2.1				0	0					0.93
14:31:21.250											0	0	0.949
14:31:21.375			2.5	-1.1									0.957
14:31:21.500					239					22.5			0.949
14:31:21.625			2.5				0	0					0.949
14:31:21.750	66												0.938
14:31:21.875		72	2.5	0									0.938

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:31:22.000						-626			22.5				0.938
14:31:22.125			2.5				0	0					0.918
14:31:22.250											0	0	0.949
14:31:22.375			2.5	1.4									0.949
14:31:22.500					239					22.5			0.938
14:31:22.625			2.1				0	3.9					0.918
14:31:22.750	50												0.918
14:31:22.875		56	2.1	2.8									0.91
14:31:23.000						-690			22.5				0.93
14:31:23.125			2.1				0	0.7					0.93
14:31:23.250											0	0	0.93
14:31:23.375			2.1	3.5									0.93
14:31:23.500					240					22.5			0.91
14:31:23.625			2.1				0	0					0.918
14:31:23.750	37												0.93
14:31:23.875		42	2.1	3.9									0.93
14:31:24.000						-759			22.5				0.91
14:31:24.125			2.1				0	0					0.898
14:31:24.250											0	0	0.91
14:31:24.375			2.1	3.2									0.918
14:31:24.500					241					22.5			0.918
14:31:24.625			2.1				0	0					0.93
14:31:24.750	23												0.938
14:31:24.875		28	2.1	1.1									0.93
14:31:25.000						-809			22.5				0.93
14:31:25.125			2.1				0	0					0.938
14:31:25.250											0	0	0.965
14:31:25.375			2.1	-0.4									0.938
14:31:25.500					241					22.5			0.949
14:31:25.625			2.8				-16.2	0					0.984
14:31:25.750	8												0.977
14:31:25.875		13	3.5	0.7									0.984
14:31:26.000						-585			22.5				1.035
14:31:26.125			4.6				-16.3	-1.8					1.063

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:31:26.250											0	0	1.063
14:31:26.375			4.9	0.7									1.852
14:31:26.500					241					22.5			2.504
<b>14:31:26.625</b>			<b>4.9</b>				<b>-14.2</b>	<b>-1.2</b>					<b>2.512</b>
14:31:26.750	-2												1.871
14:31:26.875		-1	5.3	-2.5									0.996
14:31:27.000						438			36.56				0.891
14:31:27.125			6				0.7	-2					0.871
14:31:27.250											0	0	0.852
14:31:27.375			6.3	-2.1									0.949
14:31:27.500					240					36.56			0.949
14:31:27.625			7				1.4	-1.1					0.949
14:31:27.750	3												0.996
14:31:27.875		2	6.7	0									1.016
14:31:28.000						322			25.31				1.004
14:31:28.125			6.3				6.6	-2.2					0.996
14:31:28.250											0	0	0.957
14:31:28.375			5.6	2.5									0.879
14:31:28.500					239					30.94			0.754
14:31:28.625			4.6				7.3	-1.1					0.68
<b>14:31:28.750</b>	<b>9</b>												<b>0.582</b>
<b>14:31:28.875</b>		<b>8</b>	<b>4.2</b>	<b>3.9</b>									<b>0.535</b>
14:31:29.000						-156			-2.81				0.449
14:31:29.125			4.2				-13	-2.8					0.457
14:31:29.250											0	0	0.477
14:31:29.375			4.9	3.9									0.496
14:31:29.500					240					-2.81			0.504
14:31:29.625			6				-11.9	-3.3					0.543
14:31:29.750	4												0.594
14:31:29.875		7	6.7	2.8									0.629
14:31:30.000						-668			-2.81				0.648
14:31:30.125			7				-8.4	0					1.215
14:31:30.250											0	0	2.379
<b>14:31:30.375</b>			<b>6.3</b>	<b>-2.5</b>									<b>3.164</b>

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:31:30.500					240					-2.81			2.367
14:31:30.625			6				-16.1	-0.3					0.965
14:31:30.750	-1												0.477
14:31:30.875		-1	5.3	-2.8									0.418
14:31:31.000						-256			-2.81				0.379
14:31:31.125			4.9				1.9	0					0.457
14:31:31.250											0	0	0.496
14:31:31.375			4.2	-1.4									0.84
14:31:31.500					239					-2.81			1.57
14:31:31.625			3.2				-8	-0.5					1.871
14:31:31.750	-2												1.582
14:31:31.875		-1	2.1	-0.4									0.996
14:31:32.000						-277			-14				0.344
14:31:32.125			1.4				-2	0					0.379
14:31:32.250											0	0	0.707
14:31:32.375			0.7	-0.4									1.234
14:31:32.500					238					-14			1.516
14:31:32.625			0.4				-5.4	0					1.148
14:31:32.750	-1												0.746
14:31:32.875		0	0	-0.4									0.641
14:31:33.000						-126			-22.5				0.719
14:31:33.125			0				-3	0					0.996
14:31:33.250											0	0	1.16
14:31:33.375			0	-0.7									1.129
14:31:33.500					238					-22.5			0.938
14:31:33.625			-0.4				-1.6	0					0.793
14:31:33.750	-1												0.813
14:31:33.875		1	-0.4	-0.7									0.91
14:31:34.000						-36			-22.5				1.004
14:31:34.125			0				-1.8	0					1.063
14:31:34.250											0	0	0.949
14:31:34.375			0	-0.7									0.859
14:31:34.500					240					-22.5			0.859

Time	RA 1	RA 2	Pitch	Roll	Hdg	Vert Spd	P1 Pitch Input	FO Pitch Input	Th Lever 1	Th Lever 2	AP 1	AP 2	Vert Acc
14:31:34.625			0				-0.2	0					0.859
14:31:34.750	-1												0.965
14:31:34.875		1	0	-0.7									1.063
14:31:35.000						-101			-22.5				1.016

As per CVR recording, the approach briefing was carried out by crew before asking descent from ATC. After obtaining necessary clearance the aircraft initiated descend. It is also observed that the PIC was continuously briefing the First Officer for any deviation or inappropriate command by her during the approach. Whenever, he noticed improper flaring he advised the FO to correct the same and at last he felt that FO is unable to handle the control, he took-over the controls and advised the FO that he will take-care. No response from FO was heard after that and aircraft touched the runway and made a bounced landing followed by a hard landing.

#### **1.12 WRECKAGE AND IMPACT INFORMATION:**

Aircraft landed safely on main landing gear and bounced. Heavy landing report was auto-generated. Pilot also reported hard landing and made the entry in the techlog. Aircraft remained on ground at Raipur till 19.12.2016. Detailed inspection was carried out as per Heavy Landing inspection schedule. No damage to the aircraft was observed. On 19.12.2016 aircraft was permitted to operate a ferry flight from Raipur to Delhi under special flight permit by DGCA for further inspection/maintenance at Delhi. All the structural items were inspected and found satisfactory. Main Landing Gears and Nose Landing Gear were replaced at Delhi as per AMM. Aircraft released for normal flying on 30.12.2016.

#### **1.13 MEDICAL AND PATHOLOGICAL INFORMATION:**

Both the crew had undergone pre-flight breath analyser check as per the provision of CAR Section 5 Series F Part III. No indication of alcohol consumption by any of the involved crew was observed during the check.

#### **1.14 FIRE:**

There was no pre/post incident fire.

#### **1.15 SURVIVAL ASPECTS:**

All the persons on-board the aircraft including 06 crew were safe.

#### **1.16 TESTS AND RESEARCH:**

In view of the auto-generated heavy landing report, DFDR and CVR data was downloaded and analysed. As per DFDR data, vertical acceleration was recorded 2.512g followed by 3.164g against the manufacturer's limit 2.6g. This was classified as heavy landing.

As per heavy landing inspection schedule, inspection of main landing gear was carried out. Functional test of normal extension and retraction, and free-fall of the landing gear was performed and found satisfactory. Inspection of wing, flaps, fuselage, tail section, water tanks, avionics compartment, equipment/ furnishings was carried out and no damage was observed. Aircraft cleared for ferry flight to Delhi for additional inspections recommended by M/s Airbus. During special inspection, no damage/ crack were observed to the aircraft structure, landing gear assembly and attachments etc. Boroscopic inspection was carried out of both the engines and found satisfactory. As a precaution both the Main Landing Gears & Nose Landing Gears were replaced. Aircraft released for normal flying.

#### **1.17 ORGANIZATIONAL AND MANAGEMENT INFORMATION:**

M/s Indigo is a scheduled airline operator with its main base at IGI Airport, New Delhi. It started its operation in 2006 with Airbus A-320 aircraft. It is operating Domestic and International sectors with a fleet of 129 aircraft till December 2016. It is the largest low cost airline in India and fleet size is continuously increasing.



The company is headed by a Chief Executive Officer assisted by a dedicated team of aviation and management professionals in their respective areas.

### **1.18 ADDITIONAL INFORMATION:**

As per the PIC statement, the first officer was responding to all his training instructions and communications with ATC. The aircraft was fully configured for ILS approach at 1500 ft and stabilised by 1000 ft. Minor deviations in pitch & roll were being corrected by first officer as per the instructions of PIC as well as on her own. After passing 50 ft, PIC noticed a weak flare and tried to give pitch-up input. However, aircraft touched the runway and made a bounce which resulted into hard landing. After 50ft Radio Altitude to the end of landing roll, no response was received from the first officer.

First officer submitted that during the flare check after passing 50 ft, she noticed that flare was not adequate. PIC advised her to flare the aircraft and gave the input but aircraft touched the runway leading to a bounced & hard landing. However, in her another submission to M/s Indigo, she submitted that as per earlier briefing she was totally focussed on maintaining the center line and did not give the adequate flare input in time. When PIC gave the flare input, aircraft landed hard on main gear.

### **1.19 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES.**

Nil.

## **2. ANALYSIS:**

**2.1. Aircraft:** Aircraft had valid Certificate of Airworthiness. Last ARC was renewed on 20.02.2016 which was valid till 19.02.2017. All the inspections were carried out whenever due as per the approved schedules. Last major inspection of 750 Hrs/120 days was carried out at aircraft TSN 24155 Hrs on 10.12.2016.

**2.2. Weather:-** Weather was normal throughout the flight and no significant change was observed.

**2.3. Flight Recorders:** PIC was continuously monitoring the flight parameters and aircraft configuration. However, no input by the PIC is noticed and at last at 8ft above the runway, he tried to give the pitch input. Pitch increased from 2.1° at 8ft to 4.9° at the time of touch-down within a period of 0.875 seconds. The vertical acceleration at the time of first touch-down was recorded 2.512g. Aircraft bounced and again touched-down the runway with pitch angle 6.3°, at ROD 668ft/min with vertical acceleration of 3.164g. However, no response from the FO recorded during and after the touch down.

**2.4. Flight Crew:** PIC had flown various types of aircraft as PIC. He had 9801:53 hrs of total flying experience out of which 6999:20 Hrs as PIC. He had 6827:20 Hrs flying experience on the Airbus 320 aircraft as PIC. He was not involved in any Accidents or Serious Incidents previously.

First Officer had total flying of 351:21 Hrs out of which only 69:00 Hrs. on A-320 aircraft as First Officer. She was not involved in any accident or serious incident previously.

Both crew had valid licenses. Both the crew were undergone pre-flight breath analyser test. FDTL of both the crew was within limit.

First officer was continuously responding instructions of PIC. After passing 50ft, weak flare was noticed by PIC and advised the FO to correct the same. First Officer also admitted that after 50ft, flare was not adequate. PIC advised her to flare the aircraft and at the last he gave the pitch input. At the same time the aircraft touched the ground, bounced and made the hard landing. During her another submission, she submitted that as per earlier briefing she was totally focussed on maintaining the center line and did not give the adequate flare input in time. When PIC gave the flare input, aircraft landed hard on main gear.

In view of above, it is observed that First Officer was not focussed on the tasks she had to perform during the approach & landing. Also, PIC noticed weak flare,

but appropriate action by the PIC was not taken timely. He had to initiate Go-around, if he already noticed weak flare leading to unstabilised approach.

### **3. CONCLUSIONS:**

#### **3.1. FINDINGS:**

1. Aircraft had valid Certificate of Airworthiness.
2. PIC had sufficient flying experience on the type of aircraft. However, FO had flown for 69:00 hrs as FO on the type.
3. Both the crew had undergone Pre-Flight Breath Analyser test and they were not detected under the influence of alcohol.
4. Flight Duty Time of both the crew was found to be within the limits.
5. Weather was normal throughout the flight after take-off from Delhi till landing at Raipur.
6. Aircraft Controls were with the First Officer under the supervision of PIC during the final approach.
7. The PIC was continuously monitoring inputs by First Officer, and he noticed weak flare at 50 ft above the runway.
8. At last PIC tried to give the pitch input at 8ft above the runway.
9. The aircraft touched down at a vertical acceleration of 2.512g.
10. The aircraft bounced in air upto 9ft and touched-down at high pitch of 6.3° with vertical acceleration of 3.164g which is more than the structural limit.
11. First Officer did not respond after taking over the controls by the PIC and during the landing roll.
12. PIC failed to take-over the controls timely and to initiate the Go-around when he noticed unstabilised approach at 50ft height

#### **3.2 PROBABLE CAUSES:**

The incident occurred due to inadequate flare by the co-pilot during landing.

Delayed decision by the PIC and not initiating the go-around timely are the contributory factors to the incident.

#### **4. SAFETY RECOMMENDATIONS:**

Necessary corrective training to be given to both the pilots.



(Rupinder Singh)

Assistant Director Air Safety

Place: New Delhi

Dated : 04.01.2019

## **ABBREVIATIONS USED IN THE REPORT**

AME	:	Aircraft Maintenance Engineer
ALW	:	All-up Landing Weight
ARC	:	Airworthiness Review Certificate
ATC	:	Air Traffic Control
ATPL	:	Airline Transport Pilot License
AUW	:	All-up Weight
CAR	:	Civil Aviation Requirements
C.G.	:	Center of Gravity
C of A	:	Certificate of Airworthiness
C of R	:	Certificate of Registration
CAT	:	Category
CPL	:	Commercial Pilot License
CVR	:	Cockpit Voice Recorder
DGCA	:	Directorate General of Civil Aviation
DFDR	:	Digital Flight Data Recorder
DI	:	Daily Inspection
DVOR	:	Doppler VHF Omnidirectional Range
ELT	:	Emergency Locator Transmitter
FDR	:	Flight Data Recorder
FDTL	:	Flight Duty Time Limitations
FEW	:	Few clouds
FO	:	First Officer
HZ	:	Haze
IAS	:	Indicated Air Speed
ICAO	:	International Civil Aviation Organisation
ILS	:	Instrument Landing System
IMD	:	Indian Meteorological Department
IST	:	Indian Standard Time

LIZFW	:	Loaded Index at Zero Fuel Weight
LITOW	:	Loaded Index at Take-off Weight
LTC	:	Line Training Captain
MLG	:	Main Landing Gear
NDB	:	Non Directional Beacon
NOSIG	:	No Significant Change
NSC	:	No Significant Cloud
OVC	:	Overcast Cloud
PAPI	:	Precision Approach Path Indicator
PIC	:	Pilot-in-Command
POH	:	Pilot's Operating Handbook
QNH	:	Pressure Setting to Indicate Elevation
RA	:	Radio Altitude
ROD	:	Rate of Descent
RWY	:	Runway
SB	:	Service Bulletin
SCT	:	Scattered
TSN	:	Time Since New
TSO	:	Time Since Overhaul
UTC	:	Universal Time Coordinated
VERP	:	Raipur Airport (Code)
VHF	:	Very High Frequency
VOR	:	VHF Omni Range